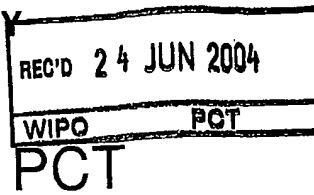


PATENT COOPERATION TREATY



From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION See paragraph 2 below

International application No.
PCT/GB2004/001293

International filing date (day/month/year)
25.03.2004

Priority date (day/month/year)
09.04.2003

International Patent Classification (IPC) or both national classification and IPC
C04B35/50, H01M8/12

Applicant
CERES POWER LIMITED

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/GB2004/001293

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ in written format
 - ☐ in computer readable form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/GB2004/001293

Box No. II Priority

1. ☒ The following document has not been furnished:

☒ copy of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(a)).

☐ translation of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(b)).

Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/GB2004/001293

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

- ☐ the entire international application,
- ☒ claims Nos. 1-11(in part)

because:

- ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):
- ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):
- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.
- ☒ no international search report has been established for the whole application or for said claims Nos. 1-11(in part)
- ☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:
 - the written form ☐ has not been furnished
 - ☐ does not comply with the standard
 - the computer readable form ☐ has not been furnished
 - ☐ does not comply with the standard
- ☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.
- ☐ See separate sheet for further details

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/GB2004/001293

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-24
	No: Claims	25-33
Inventive step (IS)	Yes: Claims	-
	No: Claims	1-33
Industrial applicability (IA)	Yes: Claims	1-33
	No: Claims	-

2. Citations and explanations

see separate sheet

Box No. VI Certain documents cited

1. Certain published documents (Rules 43bis.1 and 70.10)

and / or

2. Non-written disclosures (Rules 43bis.1 and 70.9)

see form 210

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Section III

1. Present claims 1-11 relate to a method of calculating the effective amount of divalent cations in any fabricated electrolyte. Support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT is to be found, however, only for ceria-based electrolytes (see examples). There are no examples providing any teaching that the empirical formula used to determine the effective concentration of divalent cations in ceria-based electrolytes is also valid for other electrolytes. In the present case, the claims so lack support, and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Consequently, the search has been carried out for those parts of the claims which appear to be supported and disclosed, namely those parts relating to the method claims 12-24, product claims 25-33 and claims 1-11 (in part), ie. restricted to a method determining the effective concentration of divalent cations in a ceria-based fabricated electrolyte. Moreover, it was assumed that the effective concentration is defined by the formula on page 6, l. 20.

In accordance with Rule 66.1(e) PCT, only the subject-matter which was searched was subjected to examination.

Section V

2. Reference is made to the following documents:

D1: EP-A-1 000 913 (EIDGENOESS TECH HOCHSCHULE) 17 May 2000
(2000-05-17)
D2: EP-A-1 254 862 (AIR PROD & CHEM) 6 November 2002 (2002-11-06)
D3: OISHI N. ET AL.: "Stainless Steel Supported Thick Film IT-SOFCs for
Operation at 500 - 600 degree C" JOURNAL OF THE ELECTROCHEMICAL
SOCIETY PROCEEDINGS, vol. 2002-21, 2002, pages 230-237,
XP009032114

3. The examination with regard to novelty and inventive step was carried out in light of the objections raised in Section VIII and in light of the description.

4. The subject-matter of claims 25-33 does not appear to fulfil the requirements of Article 33(2) PCT. The reasoning is as follows:
 - 4.1 Document D1 (figures 1 and 2) discloses CGO electrolytes doped with 0.01 and 0.1 mole% Co and Cu. The concentration of trivalent cations is not given, but can be assumed to be at the level of impurities and in any case Y can be chosen to have any value. Furthermore, it is apparent from figures 7 and 8 that densities of greater than 97% of theoretical were achieved both for samples of CGO without doping and CGO + 2 mol.% Cu or Co. Thus, it can be assumed that the samples doped with only 0.1 and 0.01 mol-% Cu or Co also achieved near theoretical densities (> 97%). Indeed, the fact that the CGO sample without doping also achieved a very high density suggests that the CGO contains only low levels of trivalent impurities. Document D1 appears to be prejudicial to the novelty of claims 25-33.
 - 4.2 Document D2 (in particular example 2 (comparative), examples 6-11 and abstract) appears to disclose ceria-based electrolytes falling within the definition of claims 25-29 and 33.
 - 4.3 Document D3 (p. 233-236, figure 6) appears to be relevant with regard to the novelty of claims 25-33. This document discloses depositing a CGO film on stainless steel (Fe-18Cr) and with sintering in a controlled atmosphere at 1000°C. Moreover, it was observed that Fe and Cr diffuse into the film. There is not specific mention of the relative concentrations of divalent and trivalent cations in the electrolyte, but the similarity of the process used in D3 with the method used in the examples of the current application, coupled with the fact that sintering was possible at 1000°C implies that the effective concentration of divalent cations in D3 falls in the range defined in claim 25.
5. The involvement of an inventive step (Art. 33(3) PCT) is not acknowledged for claims 1-24 as it appears that the invention has not been sufficiently disclosed (see Section VIII, 7.2).

Section VI

6. The following document could be relevant in a subsequent European Phase:

D4: WO 03/075382 A (CERES POWER LTD) 12 September 2003 (2003-09-12)

Section VIII

7. The application does not fulfil the requirements of Articles 5 and 6 PCT. The reasoning is as follows:

- 7.1 Present claims 1-11 relate to a method for calculating the effective amount of divalent cations in any fabricated electrolyte. Support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT is to be found, however, for only ceria-based electrolytes (see examples). There are no examples providing any teaching that the empirical formula used to determine the effective concentration of divalent cations in ceria-based electrolytes is also valid for other electrolytes. Thus, claims 1-11 lack support for part of their scope.

Indeed, it is apparent from the application as a whole that the "effective concentration" refers to a concentration effective for obtaining ceria-based electrolytes, which can be sintered at temperatures of 1200°C or less. This is not reflected in claim 1.

- 7.2 Furthermore, it is not clear whether the method of determination of the effective concentration has been sufficiently disclosed (Art. 5 PCT). According to the description (pages 6 and 7), the amount of trivalent cations should be multiplied by a factor Y. However, Y is not precisely defined. In the description, it is merely stated that Y is typically 5-10, ie. Y could also have a different value. Moreover, it appears that Y does not necessarily have to have the same value for the same cation, but depends also the nature and distribution of the trivalent cations. In the examples, values of the product $Y(M_1^{3+})$ are given, but the separate values of Y and (M_1^{3+}) do not appear to be given. Thus, it not clear whether a person skilled in the art has enough information at his disposable to be able to determine the effective concentration, once he has determined the concentrations of divalent and trivalent ions in the fabricated electrolyte analytically.

Comment: Moreover, it is not clear whether the method can be put to practical use or not. The user can first establish after the electrolyte has been fabricated, whether the effective concentration falls within the desired range or not. The use of the empirical formula seems to lie more in the investigation of the underlying mechanism of sintering.

- 7.3 The independent claims are not clear (Art. 6 PCT), because the method of determination of the effective concentration and term adjusted concentration are insufficiently defined. The definitions and formula given on pages 6 and 7 of the description should be incorporated in at least claim 1.